

November 15, 1999

## **COMPLETION OF AS-BUILT DRAWINGS** **BY CONSTRUCTION CONTRACTOR**

### **INTRODUCTION:**

As-Built drawings are prepared to show changes made to the project during construction, and are the official records of the project at the time of construction completion. All additions, deletions and other changes made during construction are indicated by modifying the original contract drawings and specifications. Accurate as-built drawings are very important for operation and maintenance, and when modifications to a facility are made in the future, particularly for plumbing and electrical systems which are hidden from view.

Instructions for preparing high-quality As-Built drawings are contained in the following paragraphs.

### **MARKED-UP PRINTS: (Working As-Built)**

Whenever changes, additions or deletions from the original design are made during construction, they **will immediately** be noted on each of the as-built print set and in the as-built specification, as appropriate. **No other** marks, doodles, notes, or annotations shall be put on these sets of as-built prints. All changes from the contract plans which are made in the work or additional information which might be uncovered in the course of construction will be accurately and neatly recorded as they occur by means of details and notes. All changes and/or required additions to the paper prints will be clearly identified in color contrasting to blue or black, preferably **red**. The as-built print sets will be annotated in as much detail as necessary to clarify exactly what construction changes were performed.

**Areas of Concern:** The following are some of the general items that need some special checking to ensure that the marked-up prints are complete and accurate:

(1) Location, size and type of existing and new utility lines, especially underground lines within the construction area. Measurements will be shown for all change of direction points and all surface or underground components such as valves, manholes, drop inlets, clean outs, meters, etc. The descriptions of exterior utilities shall include the actual quantity, size, and material of the utility lines.

(2) Layout and schematic drawings of electrical circuits and piping.

(3) Correct dimensions and details transferred from shop drawings.

- (4) Verification of alignment, cross section, and layout of the earthwork.
- (5) Actual location of anchors, construction and control joints, etc., in concrete.
- (6) Changes in location of equipment and architectural features.
- (7) Cross out such words and phrases as "optimal requirement," "or equal," etc., and list specifically the items of material provided.
- (8) Unusual or uncharted obstructions that are encountered in the contract work area during construction.
- (9) Location, extent, thickness, and size of stone protection particularly where it will be normally submerged by water.

Mark-up Guidelines: The following information is provided to the Contractor as suggestion to improve the quality of the marked-up prints and thereby facilitate preparation of as-built drawings after construction. The most important guideline is that the marked-up changes on the prints shall be complete and understandable. The draftsman who later will make the corrections on the original tracings likely will not have worked on the original design and probably will not have been on-site during the construction of the project. Visits to the site by the draftsman, or visits to the draftsman by the construction superintendent, can be minimized by providing complete and understandable marked-up prints.

- (1) Use written explanations on As-Built drawings more frequently to describe changes - do not rely totally on graphic means to convey the revision.
- (2) Legibility of lettering and digit values shall be precise and clear when marking prints, and clarify ambiguities concerning the nature and application of change involved.
- (3) Wherever a revision is made, make changes to affect related section views, details, legend, profiles, plans and elevation views, schedules, notes and call-out designations, and mark accordingly to avoid conflicting data on all other sheets.
- (4) When changes are made, cross out all features, data and captions that relate to that revision.
- (5) When changes are required on small scale drawings and in restricted areas, suggest large scale inserts be drawn or sketched, with leaders to the location where applicable.

(6) Be sure descriptive markings in red conform with legend symbols shown, or provide a legend if other colors are used.

(7) Be sure to add and denote in legend, any additional equipment or material facilities, service lines, etc., incorporated under As-Built Revision if not already shown in legend.

(8) When attached prints (or sketches) are provided with marked-up print, indicate whether a) entire drawing shall be added to contract drawings or b) whether the contract drawings shall be changed to agree, or c) for reference only to further details not required for initial design.

(9) Make the comments on the drawing complete without reference to letters, memo's, or materials that are not also a part of the As-Built.

(10) Annotating the drawing, "Per Change Order #42," means nothing when the actual change order states, "added an additional 12 duplex" outlets or similar statements. The same is true when the drawing is marked, "changed per COE instructions." This office and ultimately the using organizations must know what was changed, how it was changed, where the items(s) were relocated to and how the affected connections were altered. Change Orders usually do not provide information as to how the facility was changed, only what was changed.

(11) The markups shall be accomplished on blue or black line copies of the **most current originals**. Frequently the packages received consist of blue or black lines which do not include one or more revisions made on the originals through the amendment process prior to contract award. This raises the question, which drawing was used for construction? This is especially true if major revision to the facility have been made on the originals.

(12) Shop drawings are to be incorporated into the As-Built drawings. They will be provided in electronic CAD file format (or 3 mil double matte polyester or photo mylar for non-electronic contracts). Hand drawn or plotted paper shop drawings will not be accepted as submittals.

The quality of shop drawings which normally accompany "As-Built" packages are **not** usable as original drawings for several reasons.

a) The "shop drawings" are not reproducible in blue line form.

b) The drawings are not of an adequate scale or are drawn to no scale and are not transferable to the CORPS drawings due to

lack of information.

c) The limited numbers of reproducible shop drawings that have been received have not been on the Corps of Engineers standard sheets sizes making it difficult to convert these drawings to standard COE drawings.

Any drawing provided by non-COE sources will be drawn in CAD. Sheets shall be drawn at the same scale as similar drawings in the set (example: Fire alarm systems shall be drawn to the same scale as the plumbing or electrical drawings). The drawing shall meet the same standards required for the rest of the drawings set. Details and sketches shall be tied to existing drawings by sheet number, detail number, etc.

#### **AS-BUILT DRAWINGS: (Final As-Builts)**

The contractor will transfer the changes from the marked-up prints to the original electronic CAD files (or original mylar drawings).

#### **DRAFTING STANDARDS:**

The Corps requires that standard professional engineering drafting practices be utilized in correcting the original contract mylar or electronic CAD drawings to show as-built conditions. In general, the letter styles, line thickness, and scale will be the same as the original drawings. Corrections will be made in black ink, unless the originals are prepared in pencil, in which case the corrections also will be in pencil. When shop drawings or other sheets are added, they will be drawn in electronic CAD or on 3 mil double matte mylar or reproduced on photo mylar and will be the same size and layout as the original drawings. The following specific requirements apply to the preparation of as-built drawings:

The Title Sheet (first sheet): The first sheet will be labeled with the word AS-BUILT (stamp to be purchased by the contractor). The words CONTRACT NUMBER and the actual contract number will be entered using a size 140 Leroy templet and a No. 1 pen (or equal CAD font style and size) as shown on attachment 1. The contract number contains the Fiscal Year, the letter C (for construction), and the sequence number (example: 96-C-0000). No other work need be done on this sheet unless sheets are being added or deleted from the List of Drawings or other actual changes are made on this sheet. (See attachment 1.)

The second and subsequent sheets: All the sheets following the title sheet will be labeled with the AS-BUILT stamp. (See Attachment 2.)

Signature representation (CAD files only): All signatures that appear on the approved original design drawings need to be represented on all the electronic as-built files. The format

for these are /s/Name (i.e. /s/Raymond Dennis). The only name that does not require the /s/ is the District Commander's name that appears only on the cover sheet (the title sheet). (See Attachments 1 & 2.)

Revisions Block entries: Those sheets which have no changes will only be labeled AS-BUILT as described above. Those sheets which have changes shown on them will have REVISED AS-BUILT entered in the first available space. This will be revision one and a number 1 will be entered in the triangle at the beginning of that line. In the event the sheet has already been revised and a number and revision appear in the revision lines the next sequential number will be used. Normally the first entry is made in the first line. The completed originals drawings (or CAD files) will be reviewed for accuracy and initialed by the Contractor. (See Attachments 2 & 3.)

Marking Revisions: All changes will be indicated by placing an equilateral triangle (3/8" per side) near the area revised. Where several items in a table or detail are changed (or completely redrawn), one triangle may be placed near the table or detail title. This same method may be used for general revisions to floor plans and system plans (plumbing, electrical, a/c, heating); when a major portion of the drawing is changed, the triangle may be placed near the diagram, detail, section or plans title. When only a few items are revised, added or deleted a triangle will be placed near each item. The triangles will contain the same number as the As-Built revision on that sheet. (See Attachment 4.)

Revision Procedure: Deletion - when the marked-up print indicates an item was not installed, the item will be crossed out on the drawing along with any associated devices, connecting lines, ducts, pipes etc., including notes and dimensions. When a detail is indicated as not being used, the detail may be boxed and NOT USED lettered across the detail. A box will be drawn on the (reverse side for manual drawings) sheet with an X as shown in Attachment 5. The words NOT USED will be in heavy block lettering a minimum of 5/8" high. A triangle and revision number will be placed inside the box where notes are indicated as not being used. Notes - a line may be drawn thru the note or line item in a table in lieu of erasing the line item or note. The line will be drawn on the reverse side for manual drawings. A triangle and number will be placed near the deleted item. Additions - When the marked-up print indicates items have been added, the new or additional item or items will be drawn on the original and associated connections made if the print indicates such connections. A triangle and number will be placed near the new item. All lettering **will conform** to the existing lettering on each sheet.

Relocations: When the marked-up print indicates an item has been moved and the new location is shown or indicated, the item will be drawn in the new location and erased from the old location. All connections will be transferred if applicable, such as wiring, piping, ducts. Revision triangles with appropriate number will be shown at the new and old location.

Drawing continuity: The applicable drawings shall be marked-up when a change was made, although this will not always be the case. Final responsibility for drawing continuity is

with the person doing the As-Built. When one floor plan indicates a wall, room, doors etc., has been changed, the same change shall be made on all other applicable drawings. When the change is applicable to only one discipline such as electrical and does not directly affect other discipline sheets, a note may be added to other discipline sheets such as "See sheet \_\_\_\_\_ for As-Built Conditions."

Shop drawings: When shop drawings are added to the original contract drawing set they need to be appropriately labeled with the Sacramento District file number, and discipline and sequence sheet number. The Index of Drawings will also need to be revised to show the additional sheet (s) with the appropriate sheet title. In the case where the shop drawing are smaller than the Corps standard sheet size (i.e. 8.5"x11" or 11"x17" etc.) the sheets will be cut into a standard Corps sheet size border sheet and appropriately labeled. (For additional information refer to Mark-up Guidelines, Shop drawings above.)

CAD Standards: All asbuilt "triangled" changes (refer to MARKED REVISIONS paragraph above) shall be on a separate single layer named ASBUILT, using a single color with an associated medium pen width. Electronic CAD file and shop drawings will conform to the Sacramento District CAD Standards and the Tri-Services CAD Standards. File Naming Convention will be maintained on all existing CAD files and followed for any new files added. (Refer to <http://www.spk.usace.army.mil/cespk-ed/cadd/standards.html>)

PRIMARY LOCATION

ALTERNATE LOCATION

AS-BUILT  
CONTR. NO: XX-C-XXXX

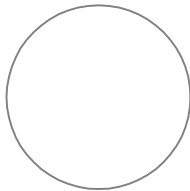
AS-BUILT  
CONTR. NO: XX-C-XXXX

BASE_NAME		PROJECT_TITLE_1 PROJECT_TITLE_2 SHEET_NAME SHEET_NAME_2 SHEET_NAME_3		STATE	
Approved Functional Adequacy Title /s/PRINTED NAME MM/DD/YY Prepared by A/E NAME AND ADDRESS /s/PRINTED NAME MM/DD/YY Title		Designed by DESIGNER Spec No. SPEC File Name FILE_NAME		Drawn by DRAFTER Design File No FILE Plot Date PLOT_DATE	
Approved /s/PRINTED NAME MM/DD/YY Chief, Engineering Division Prepared Under the Direction of		COMMANDERS NAME Col. Corps of Engineers District Engineer		AS-BUILT CONTR. NO: XX-C-XXXX	

AS-BUILT

AS-BUILT

PRIMARY LOCATION  
ALTERNATE LOCATION



DATE APPROVAL 1	DISCUSSION 1	AA
DATE APPROVAL 2	DISCUSSION 2	AA
DATE APPROVAL 3	DISCUSSION 3	AA
DATE APPROVAL 4	DISCUSSION 4	AA
DATE APPROVAL 5	DISCUSSION 5	AA
DATE APPROVAL 6	DISCUSSION 6	AA
DATE APPROVAL 7	DISCUSSION 7	AA
DATE APPROVAL 8	DISCUSSION 8	AA
DATE APPROVED	DISCUSSION	Symbol

Initials of person checking revisions  
Initials of person doing revisions

DESIGNED BY DESIGNER	DATE	Rev.
	DATE APPROVAL	REV. #
	Design File no	
	FILE. NO.	
Drawn by	Checked by	
Drawn by	Checked by	
Reviewed by	SPEC. No.	
Reviewed by	SPEC. NO.	
Submitted by	File name FILE NAME	
SIGNATURE	Plot date PLOT DATE	
DATE	Plot scale PLOT SCALE	

DEPARTMENT OF THE ARMY  
CORPS OF ENGINEERS  
SACRAMENTO, CALIFORNIA

A/E NAME AND ADDRESS

STATE
PROJECT_TITLE_1
PROJECT_TITLE_2
SHEET_NAME
SHEET_NAME_2
SHEET_NAME_3

Sheet reference number:
SHT#
SEQ#

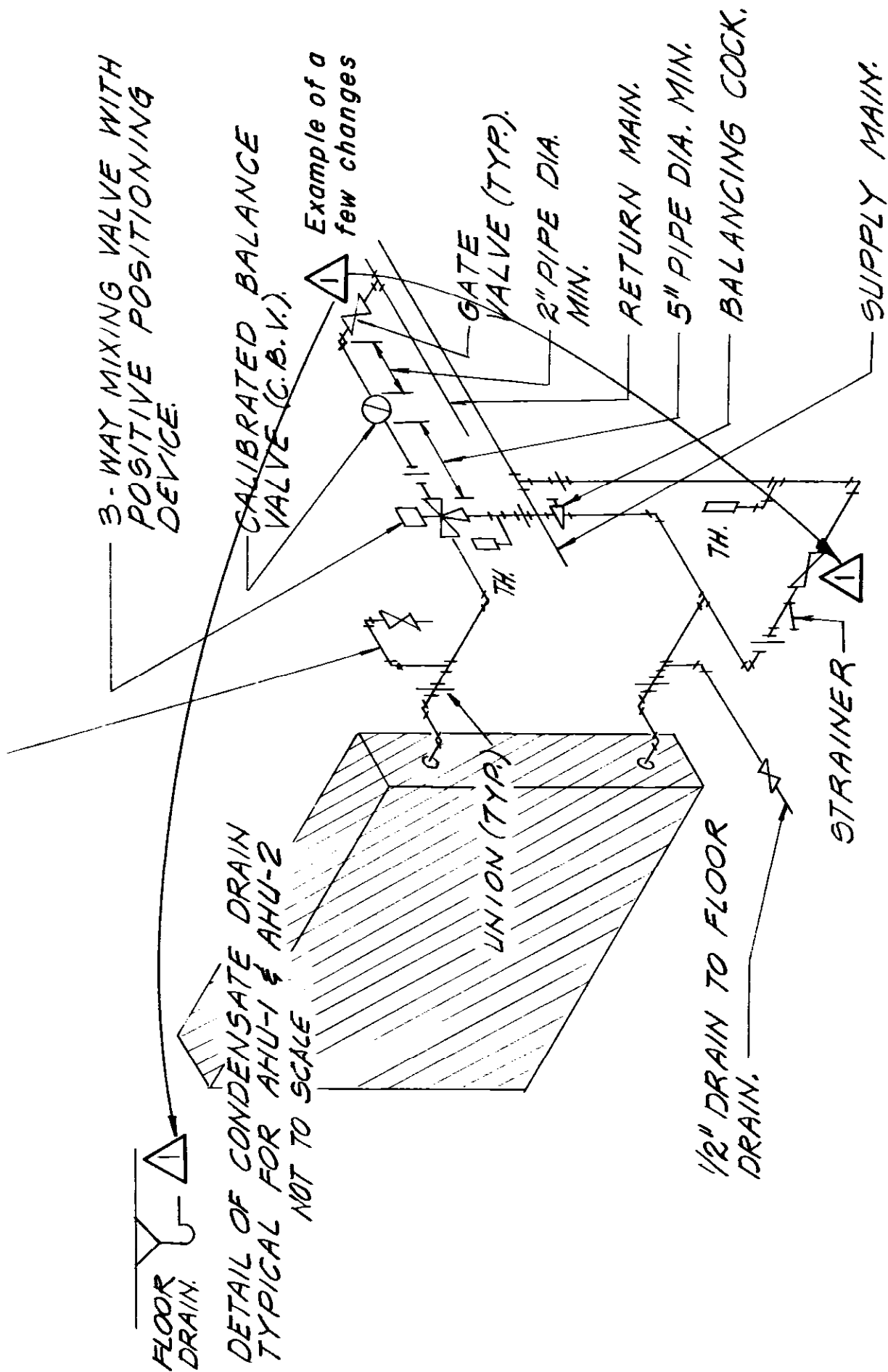




US Army Corps  
of Engineers  
Sacramento District

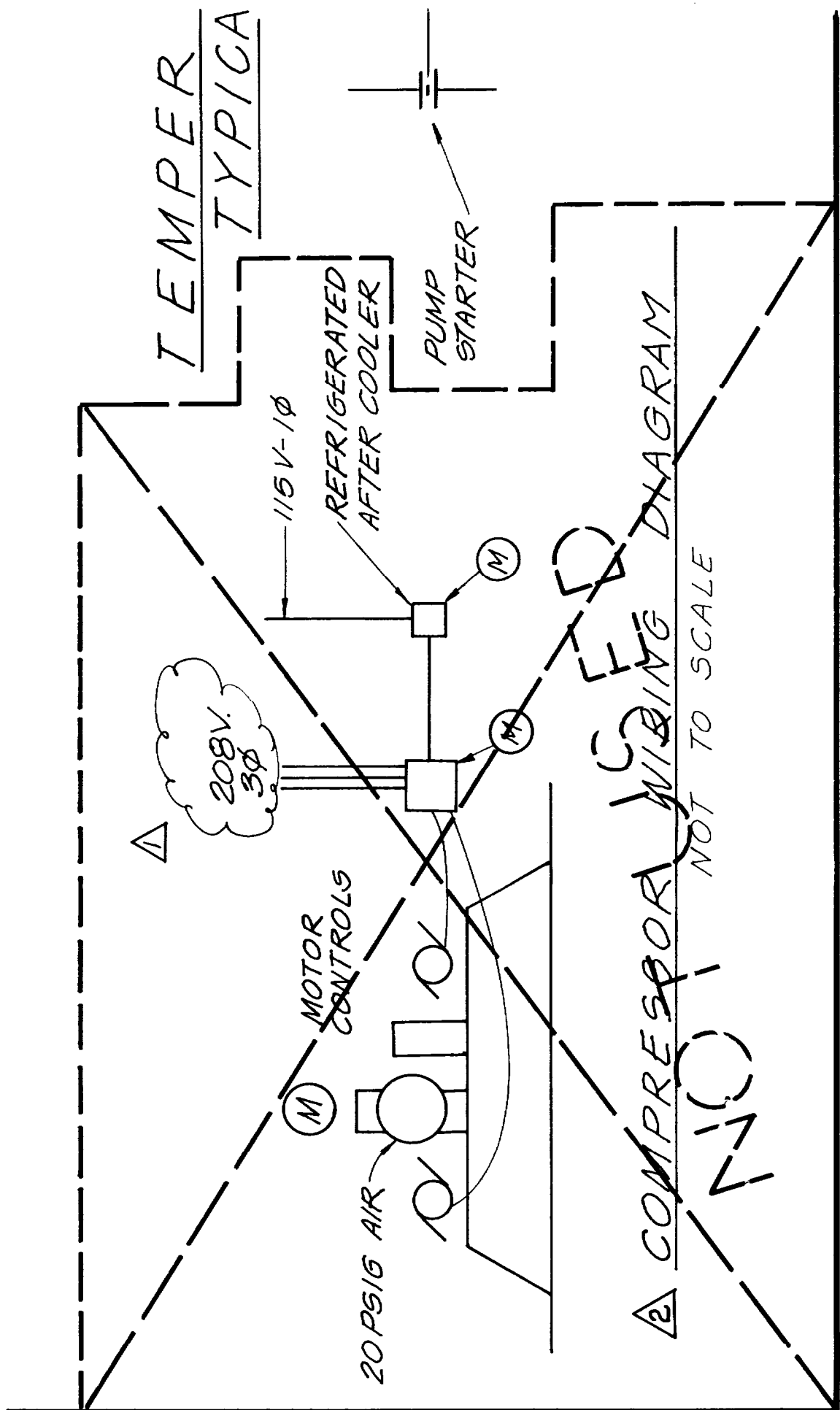
Initials of person checking revisions  
Initials of person doing revisions

Symbol	REVIS	AS-BUILT	Initials of person checking revisions	Initials of person doing revisions	Date	Approved
△						
△						
△						
△						
△						
△						
△						
△						



# TYPICAL CONNECTIONS TO CHILLED WATER COILS.

NOT TO SCALE  
 Example of general revisions



When an entire Detail, Section or View has been deleted it is indicated. Solid heavy lines are drawn on the back side of the sheet. "VOID" or "NOT USED" is lettered on the front. Dashed lines shown here for clarity.